STABRO LABORATORIES

SURVEY METER
Model 420

BAIRD-ATOMIC

ATOMIC AND LABORATORY INSTRUMENT DIVISION

125 MIDDLESEX TURNPIKE, BEDFORD, MASSACHUSETTS 01730

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MODEL 420 SURVEY METER

1.0 DESCRIPTION

1.1 The Model 420 Survey Meter is a portable, electronic, battery-operated radiation detector. Each survey meter is compact, lightweight, and rugged with a transistorized chassis, a regulated high-voltage power supply, and either a thin-wall or an end-window halogen-quenched Geiger-Mueller tube.

1.2 The Model 420 Survey Meter detects alpha-beta-gamma radiation. Two different models of this instrument are supplied.

The Model 420S GM Survey Meter consists of a chassis, a magnetic earphone, a P-131 Probe Holder with a coiled cord stretchable to 40 inches, a TWH-123 thin-wall Geiger-Mueller tube, and a check source.

The Model 420E GM Survey Meter embodies a chassis, a magnetic earphone, a P-136 Probe Holder with a connecting, coiled cord stretchable to 72 inches, an SWH-151 end-window Geiger-Mueller tube, and a check source.

1.3 The type P-131W Beta-Gamma Probe contains a thin-wall, halogen-quenched, type TWH-123 Geiger-Mueller tube in a stainless-steel 30 mg/cm^2 wall and a nickle-finished steel shield with an adjustable beta window. The P-131W Beta-Gamma Probe is suitable for detecting beta energies greater than 500 Kev and is easily disassembled for tube replacement.

1.4 The P-136W Alpha-Beta-Gamma Probe consists of a Model SWH-151 detector with a 1.4 to 2 mg/cm^2 end window in a polished steel case. The probe case has a metal cover as an alpha and beta discriminator which also protects the detector during storage.

2.0 OPERATION

2.1 Initial Operation

Before operating the Model 420 Survey Meter, set the RANGE switch to BATT and observe the meter. The meter should read in the red-lined section of the scale (above 0.7). If the meter reads below the red-lined section, refer to the maintenance instructions in this manual.

2.1.1 Probe Check

With the beta window of the probe closed, set the RANGE switch to X10. Allow 20 to 30 seconds for stabilization. The meter reading should remain essentially at zero.

2.2 Meter Scale

The "Range" switch has five positions: "OFF", "BATT", "X100", "X10", and "X1". The meter scale is graduated in milliroentgens per hour (mr/hr) and counts per minute (cpm). With the "RANGE" switch at "X1", the full scale meter indication is 1 mr/hr or 500 cpm. The "BATT" position of the "RANGE" switch checks the condition of the batteries. The meter needle should indicate in the red-lined area of the meter scale (figure 1).

2.3 Headphone Use

To use the headphone with the survey meter, fasten the headphone cable to the PHONE connector on the front panel. Check that each pulse from the probe produces a distinct, audible click in the headphone.

2.4 Natural Background Radiation

Because natural background radiation is 0.01 to 0.02 milliroentgens per hour, little instrument response will usually be observed on the meter or heard in the headphone. Usually, only randomly spaced headphone clicks and meter kicks will be heard and observed.

2.5 Radioactive Check Source

On the model 420S (side-window probe), set the RANGE switch to X10. Open the window by rotating the shield. Hold the probe so that the center of the open window is approximately 1 inch from the center of the source. The meter should read between 2000 and 3000 cpm or approximately mid-scale.

A radioactive check source on the side of the case may be used to assure that the instrument is functioning properly. On the model 420E (end-window probe) set the RANGE switch to X10. Remove the cap from the end of the probe. Hold the probe so that the window is approximately 2 inches from the center of the source. The meter should now read between 2000 and 3000 cpm or approximately mid-scale.

3.0 MAINTENANCE

3.1 Preventive Maintenance

When not in use, the survey meter should be turned off. Normally batteries last 200 hours in continuous use, but should be removed if the meter will be unused for a month or more.

3.2 Batteries

Check the batteries periodically. Place the RANGE switch to BATT and observe the meter reading. If the meter reads below the red-lined section of the scale, replace all five batteries.

3.2.1 Battery Replacement

To replace the batteries turn the survey meter on its side. Turn the Vibrex fastener on the base of the unit so that the front panel and attached interior chassis are freed from the cabinet shell. Using the probe holder, remove the front panel and interior chassis from the case. Remove the batteries from their holders and insert new batteries. Replace the chassis in the case and turn the Vibrex fastener to secure it in place.

3.3 Geiger-Mueller Tube Replacement

Halogen-quenched Geiger-Mueller tubes should rarely need replacement. However, if the Geiger-Mueller tube is damaged or defective, it must be replaced.

3.3.1 Thin-Wall Geiger-Mueller Tubes

To remove the side-wall Geiger-Mueller tube from the type P-131W probe, grasp the probe firmly and unscrew its base from the body. This action exposes the tube so that an operator can grasp the base of the Geiger-Mueller tube and pull it outward.

CAUTION

Do not grasp the Geiger-Mueller tube
by its thin wall.

To insert a new tube, align the tube pins with the socket and gently push the tube into place. Assemble the base and body of the probe.

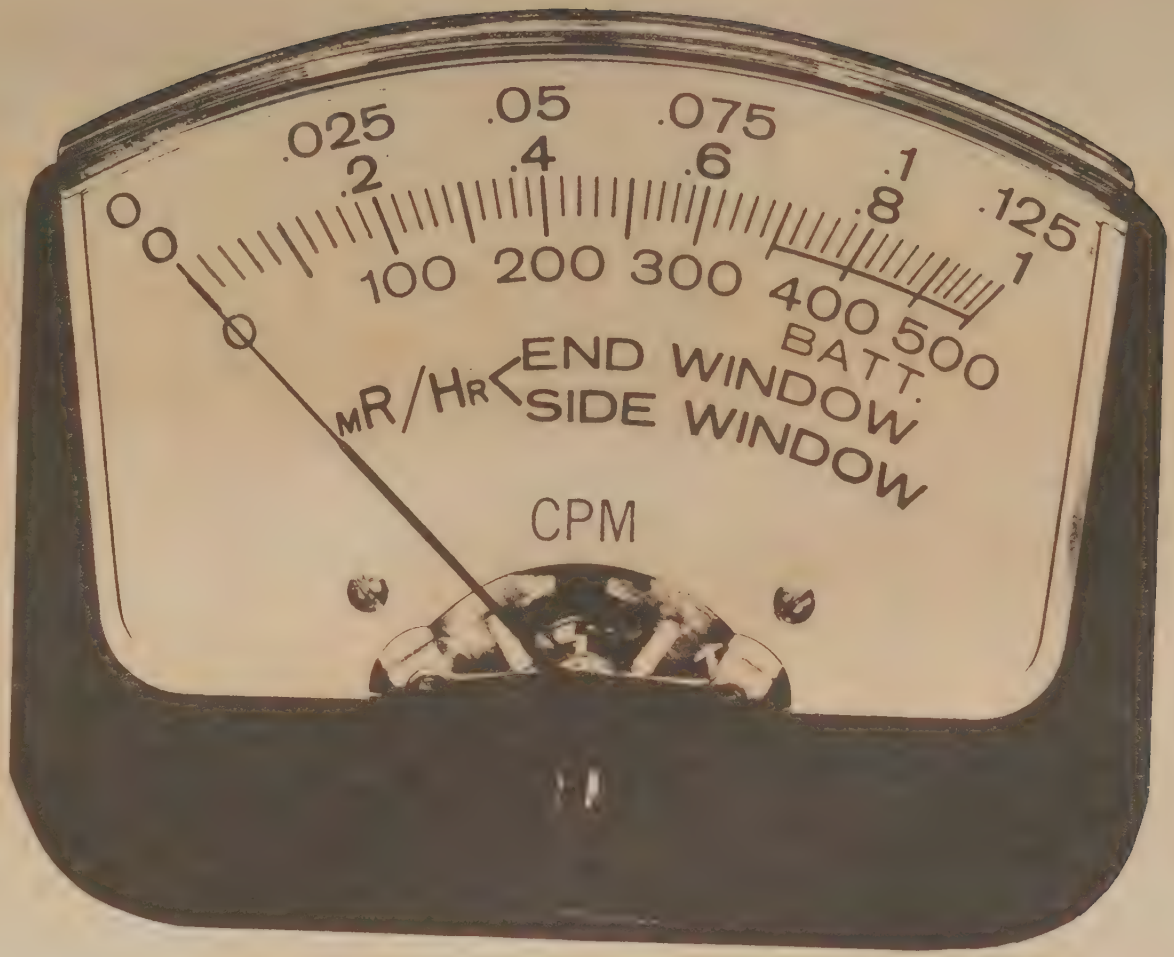


Figure 1. Meter Scale

3.3.2 End-Window Geiger-Mueller Tubes

CAUTION

The end-window of the tube is fragile.

To remove the end-window Geiger-Mueller tube from the type P-136W probe, disassemble the body of the probe from the base. Gently hold the tube by its sidewalls and slide it from the base socket.

When installing a replacement tube, leave the plastic protective cover on the tube until the tube is in the base socket and has been gently pushed into place. Then, carefully remove its plastic protective cover and reassemble the base and body of the probe.

3.4 Circuit Checks

3.4.1 Power Supply Checks

If the batteries and the Geiger-Mueller tube check properly and the instrument is still inoperative, check that the high voltage at the anode of regulator tube V-1 (see schematic diagram) is 930 ± 30 volts d-c by using a vacuum-tube voltmeter having an input impedance of 1000 megohms or greater.

If the voltage is low, adjust the HI-VOLTAGE ADJUST potentiometer, R-16, until a voltage drop of 25 ± 5 volts d-c is measured across resistor R-13 (1 megohm). If this adjustment control cannot be made, replace transistor Q-4.

If the voltage is high, replace regulator tube V-1 and adjust the HI-VOLTAGE ADJUST potentiometer, R-16.

3.4.2 Resistance and Voltage Checks

Resistance and voltage checks can be made using a 20,000 ohms per volt meter. To prevent component damage, measure resistances with the RANGE switch on the survey meter at X100.

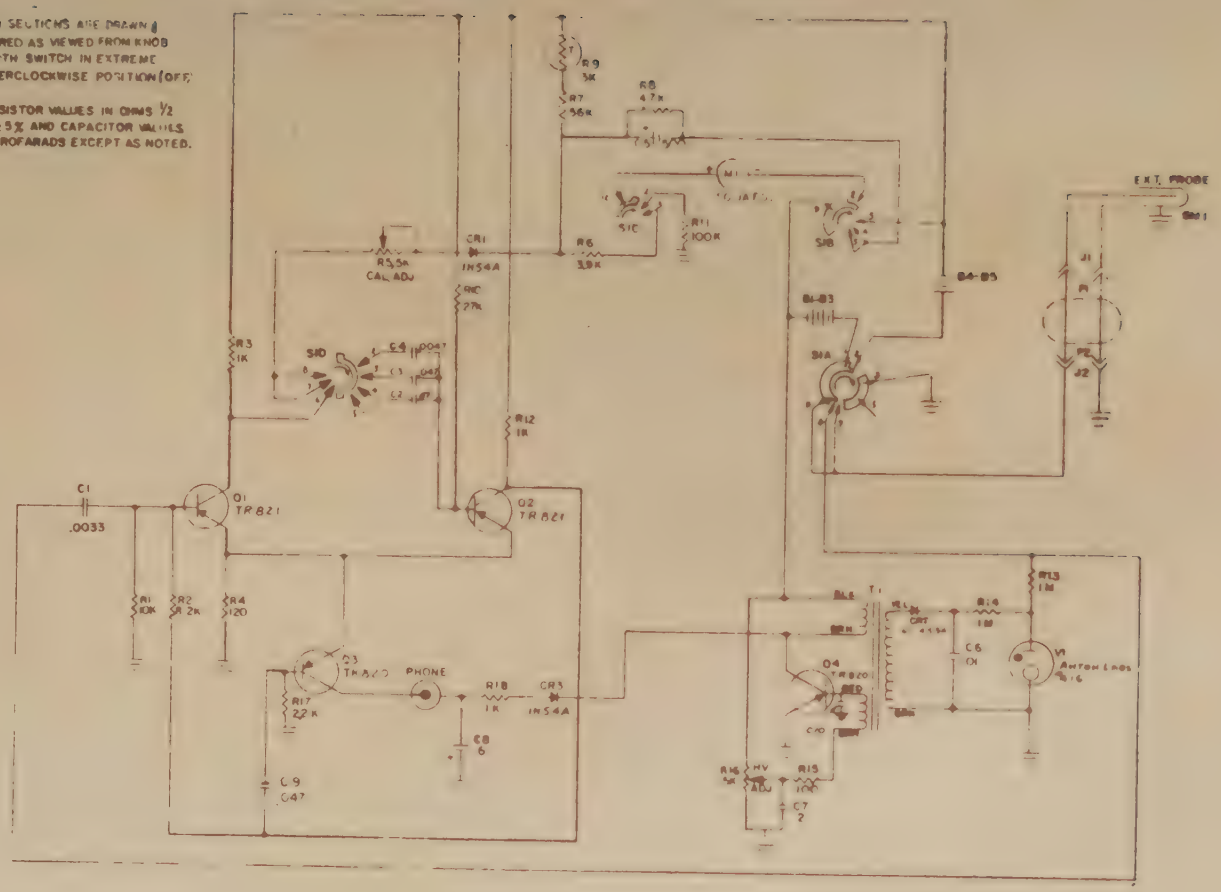
Access to the printed-circuit board is attained by removing the survey meter from its case and then removing the screws which hold the battery bracket.

4.0 PARTS LIST

Symbol	Description	B/A Part No.
C1	Capacitor, 3300μμf, 1400V	08257
C2	Capacitor, 0.47μf, 200V	00734
C3	Capacitor, 0.047μf, 200V	00731
C4	Capacitor, 4700μμf, 600V	00722
C5	Capacitor, 500μf, 6V	08258
C6	Capacitor, 0.01μf, 1400V	08259
C7	Capacitor, 2μf, 6V	08260
C8	Capacitor, 6μf, 40V	08261
C9	Capacitor, 0.047μf, 200V	00731
C10	Capacitor, 0.1μf, 200V	00583
CR1	Diode, 1N54A	08262
CR2	Rectifier, Selenium, 3 ma, 1800V rms	08263
CR3	Diode, 1N54A	08262
Q1	Transistor, Indus TR 821 GE, PNP	08266
Q2	Transistor, Indus TR 821 GE, PNP	08266
Q3	Transistor, Indus TR 820 GE, PNP	08267
Q4	Transistor, Indus TR 820 GE, PNP	08267
R1	Resistor, 10K, 1/2W, 5%	00368
R2	Resistor, 8.2K, 1/2W, 5%	00374
R3	Resistor, 1K, 1/2W, 5%	00105
R4	Resistor, 120 ohms, 1/2W, 5%	00059
R5	Potentiometer, 5K, 1/2W, 20%, linear taper	08255
R6	Resistor, 3.9K, 1/2W, 5%	00180
R7	Resistor, 56K, 1/2W, 5%	00331
R8	Resistor, 4.7K, 1/2W, 5%	00173

4.0 PARTS LIST (Cont.)

Symbol	Description	B/A Part No.
R9	Thermistor, 3K, 33D2	08256
R10	Resistor, 27K, 1/2W, 5%	00349
R11	Resistor, 100K, 1/2W, 5%	00319
R12	Resistor, 1K, 1/2W, 5%	00105
R13	Resistor, 1 Meg, 1/2W, 5%	00263
R14	Resistor, 1 Meg, 1/2W, 5%	00263
R15	Resistor, 100 ohms, 1/2W, 5%	00058
R16	Potentiometer, 5K, 1/2W, 20%, linear taper	08255
R17	Resistor, 2.2K, 1/2W, 5%	00134
R18	Resistor, 1K, 1/2W, 5%	00105
T1	Transformer, M8050	08264
V1	Tube, regulator, 416	08265



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Schematic Survey Meter Model 420

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BAIRD-ATOMIC LIMITED, 42 STATION LANE, HORNCHURCH, ESSEX, ENGLAND

Printed in U.S.A.